

Appl. No. 10/800,888
Amdt. dated September 20, 2006
Reply to Office Action of June 20, 2006

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REMARKS

Entry of the foregoing and further consideration of the subject application in light of the remarks which follow and consistent with 37 CFR § 1.111 are hereby respectfully respectfully requested.

Claims 1 through 26 are pending and Claims 27 through 49 are withdrawn. Claims 1 and 23 have been amended.

Claim 1 has been amended to specify that the treatment is carried out for a period of time of at least 4 hours. Support for this amendment is found in paragraph [0034] on Page 11 of the application. In addition, Claims 1 and 23 have been amended to specify that the treatment feed "consists essentially of" hydrogen. Support for this amendment is found in several portions of the application including paragraphs [0032] through [0034] and Examples 1 through 3. The "consisting essentially of" transitional phrase with respect to the treatment feed excludes the presence of aromatic compounds, such as toluene, from the treatment feed. Further, Claims 1 and 23 has been amended to replace "contacting" with "treating". Support for this amendment is found in paragraph [0032] of the application. Still further, Claim 1 has been amended to specify that the hydrogen treatment reduces the hydrogenation activity of the catalyst by at least 10 percent (in comparison to the untreated catalyst). Support for this amendment is found in paragraph [0035] of the application.

The Restriction Requirement

With regard to the requirement for election and restriction between the Group I claims (Claims 1-26) and Group II claims (Claims 27-49), the Applicants affirm the election of the Group I claims, but traverse the restriction requirement. It is believed that the Group II claims are so closely related to the Group I claims that they should remain in the same application in order to preserve unity of invention.

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The different classifications of the Group I and II claims have been noted, but it is believed that these classifications are not necessarily conclusive on the question of restriction and election. It is believed that the restriction requirement draws too fine a line of distinction and that when all the facts are taken into account, the Group II claims should remain in this application. Furthermore, it is believed that a search of one Group would necessitate a search for the other, and therefore, it would be efficient to search both groups together.

In any case, although the election of the Group I claims is affirmed, the Applicants reserve the right to file a divisional application for the subject matter of the Group II claims and, hence, the Applicants do not waive any rights with respect to the subject matter of the Group II claims.

REJECTION UNDER 35 U.S.C. § 112

Claims 5, 6, and 16 stand rejected by the Examiner under 35 U.S.C. § 112, second paragraph. In making this rejection, the Office Action states that Claims 5, 6, and 16 lack antecedent basis for the recitation "treated catalyst". This rejection is respectfully traversed with respect to presently pending Claims 5, 6, and 16.

Amended Claim 1 now recites "treating the catalyst with a feed consisting essentially of hydrogen". Such amendment provides antecedent basis for the recitation "treated catalyst" in Claims 5, 6, and 16.

Applicants respectfully submit that Claims 5, 6, and 16 are in compliance with 35 U.S.C. § 112, second paragraph. Withdrawal of this rejection is respectfully requested.

REJECTION UNDER 35 U.S.C. § 103

Applicants' Claimed Invention

The use of catalysts in hydrocarbon conversion with a hydrogenation activity that is too high can cause deleterious effects, e.g., loss of valuable compounds and damage to equipment and catalyst. For example, if the catalyst used in a xylenes isomerization/ethylbenzene

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dealkylation reactions has hydrogenolysis activity that is too high, ethylene formed in the dealkylation of ethylbenzene to ethylene and benzene can be cracked to methane. In addition, the ethylene cracking reaction generates a large amount of heat, which can cause large exotherms inside the reactor, which can lead to damage of the catalyst, equipment, or both. Still further, if catalysts used in aromatics conversion have addition hydrogenolysis activity that is too high, the aromatic compounds can undergo aromatic ring saturation, which results in the loss of high value aromatics, e.g., xylenes.

The presently claimed invention, as set forth in Claims 1 through 26, involves treating a molecular sieve catalyst containing a Group VIIB or Group VIII metal with hydrogen to reduce the hydrogenation activity of the catalyst by at least 10 percent (in comparison to the untreated catalyst). Applicants' process is carried out by treating the catalyst with a feed consisting essentially of hydrogen under sufficient conditions of temperature and pressure and for a time of at least 4 hours to reduce the hydrogenation activity of the treated catalyst in an amount of at least 10 percent in comparison to the untreated catalyst. As shown in Examples 2 and 3 of the present application, the practice of the Applicants' invention substantially reduces the hydrogenation activity of the catalysts.

Applicants believe that hydrogenation activity reduction is due to chemical bonding of hydrogen to the hydrogenation metal atoms. This bonding causes inactivation of at least a portion of the hydrogenation metal atoms. The hydrogen to hydrogenation metal bonding is a slow and difficult process that is dependent upon the hydrogenation metal present in the catalyst, the hydrogen pressure of the treatment, the temperature of the treatment, and the duration of the hydrogen exposure to the hydrogenation metal. Independent Claims 1 and 23 specify an extended hydrogen treatment time (treatment time of at least 4 hours).

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Rejection based on U. S. Patent 5,990,365

Claims 1 through 26 stand rejected under 35 U.S.C. § 103 as being unpatentable over U. S. Patent 5,990,365 (Chang et al.). This rejection is specifically traversed as the invention, as set forth in presently pending Claims 1 through 26, is submitted to be patentable over Chang et al.

In making the rejection, the Office Action sets forth the following remarks:

Chang et al are relied on for the teaching of liquid phase ex situ preselectivation of ZSM-5 carrying rhenium. The process takes place in the presence of hydrogen under toluene disproportionation conditions. The catalyst can be optionally bound. The conditions of toluene disproportionation overlap significantly with the conditions described and claimed in the instant application as 'sufficient'. Accordingly, limitations regarding the reduced activity of the catalyst are considered to be inherent to carrying out the method of the prior art due to significant overlap in the process conditions employed to bring about such result. See particularly Columns 4 and 8. It is well settled that overlapping ranges constitute a prima facie case of obviousness, and in the instant case, the degree of overlap places the preponderance of evidence of record toward a conclusion of obviousness.

As indicated in the Office Action, Chang et al. is concerned with hydrocarbon conversion, e.g., toluene disproportionation, using a selectivated ZSM-5 catalyst containing rhenium. Chang et al. does not disclose, suggest, or in any way mention reducing hydrogenation activity of a rhenium-containing ZSM-5 catalyst.

Chang et al. does not disclose or suggest at least 3 important features of the Applicants' claimed invention. First, Chang et al. does not disclose or suggest reducing the hydrogenation activity of a rhenium-containing ZSM-5 catalyst. In fact, Chang et al. appears to favor high activity because, in Column 4, lines 9 through 13, Chang et al. discloses the importance of maintaining EB reduction activity. That portion of Chang et al. is replicated below.

Data provided in Examples recited herein show that a ZSM-5 catalyst impregnated with rhenium, either before or after silicone selectivation, reduces EB and, in the case of impregnation before silicone treatment, maintains EB reduction activity even after multiple calcinations.

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EB reduction activity includes EB dealkylation with conversion of ethylene to ethane. The conversion of ethylene to ethane is caused by rhenium present in the catalyst. On the other hand, Applicants' invention is directed to the reduction of hydrogenation activity.

Further, Chang et al. does not disclose or suggest treating a zeolite catalyst containing a Group VIIB metal or a Group VIII metal with feed that consists essentially of hydrogen. The feed of Chang et al. comprises toluene and hydrogen. The reason Chang et al. includes hydrogen in its feed is to reduce aging of its rhenium-containing ZSM-5 catalyst. Chang et al. discloses this point in Column 8, line 61 through Column 9, line 12, which is replicated below.

When a reactive hydrocarbon, such as toluene is included in the feedstock, the presence of a sufficient amount of hydrogen in the selectivation feedstock is necessary to prevent rapid aging of the catalyst during the selectivation process resulting in an excessive reduction in the zeolite activity, possibly accompanied by a reduction in toluene disproportionation selectivity to para-xylene. This rapid aging is believed to result from a rapid build-up of excessive amounts of carbonaceous deposits (i.e., coke), which may even extend into the pore system of the zeolite in the catalyst. However, even when hydrogen is used in optimal fashion to prevent aging during the selectivation process, a small amount of carbonaceous deposit may form on the catalyst. The presence of hydrogen may also serve to induce or enhance the chemical reaction between the zeolite and the selectivating and the selectivating agent, which results in the functionalization of the zeolite. This chemical reaction is also believed to be induced or enhanced by elevated contact temperatures, which may be needed to maintain the silicone or silane functionalizing agent in the vapor phase.

Still further, Chang et al. does not disclose or suggest treating its catalyst to reduce hydrogenation activity for extended times (least 4 hours) to reduce hydrogenation activity by at least 10 percent. The extended treatment time is important because hydrogen to hydrogenation metal bonding is a slow and difficult process.

The Office Action states that the process conditions of Chang et al. would inherently result in presently pending Claims 1 through 26. Applicants respectfully disagree with this assertion.

An inherency rejection based on Chang et al. is proper only if the practice of conditions of Chang et al. would inevitably result in the formation of a zeolite catalyst containing a Group

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VIIB metal or Group VIII metal having the reduced hydrogenation activity (at least 10 percent reduction) as specified in Claims 1 through 26. Chang et al. would not inevitably result in the formation of such a catalyst for at least the following reasons. First, Chang et al. uses a treatment feed that contains aromatic compounds in addition to hydrogen, while the feed used in Applicants' process does not contain aromatic compounds.

Also, since hydrogenation activity reduction is due to chemical bonding of hydrogen to hydrogenation metal atoms. This bonding is a slow and difficult, and depends upon the hydrogenation metal present in the catalyst, the hydrogen pressure of the treatment, the temperature of the treatment, and the amount of time needed for treatment, the condition disclosed in Chang et al. provide no direction or guidance in achieving the hydrogenation activity reduction, as set forth in the presently pending Claims 1-26.

Applicants would like to comment on the Conclusion set forth in the Office Action. The Conclusion states that Froment (U.S. Patent 5,672,796) is pertinent because it teaches reduction of the metals on zeolite with hydrogen prior incorporation of sulfur. Applicants respectfully submit that Froment demonstrates the uniqueness of Applicants' invention. The purpose of the hydrogen treatment of Froment is for reduction of metal contained in the catalyst. The separate sulfur treatment is a well-known technique for reducing hydrogenation activity of the catalyst. Applicants' process, as set forth in Claims 1 through 26, is a method for reducing hydrogenation activity of a catalyst that avoids problems associated with Froment's sulfur treatment. Treatments using sulfur involve a toxic, corrosive, and pungent substance. Also, when the support material used in the catalyst is a molecular sieve having unidimensional ring pores, the sulfur treatment can block the pores of the molecular sieve, which usually results in reduced activity (and even deactivation) of the catalyst.

It is respectfully submitted that Chang et al. involves does not disclose or suggest presently pending Claims 1-26. Withdrawal of this rejection is respectfully requested.

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CONCLUSION

Applicants respectfully submit that presently pending Claims 1 through 26 are patentable over Chang et al. Favorable action hereon is respectfully requested.

Respectfully submitted,

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